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WHAT IS CLAIMED IS:

- A method for determining a response to administration of a chemotherapeutic or chemopreventive agent to an individual, comprising:
- (a) collecting a first tissue or cell sample from the individual before exposing the individual to the chemotherapeutic or chemopreventive agent;
- (b) collecting a second tissue or cell sample from the individual after exposing the individual to the chemotherapeutic or chemopreventive agent;
- (c) immunohistochemically staining the first and second tissue or cell samples using a detectably-labeled antibody directed against a biological marker associated with senescence, apoptosis or terminal differentiation;
- (d) measuring the optical density of the stained cells as in step (c), wherein the stained cells are illuminated with light having a wavelength absorbed by the stain;
- (e) determining whether expression of the biological marker associated with senescence, apoptosis or terminal differentiation was increased following exposure to the chemotherapeutic or chemopreventive agent.
- 2. The method of claim 1; wherein the detectable label is a chromagen or a fluoraphore.
- 3. The method of claim 2, wherein the biological marker is p21, p27, p16, TGF- β , or SA- β -Gal.
- 4. The method of claim 1, wherein the amount of biological marker protein is determined by ELISA assay.
- 5. The method of claim 1, wherein optical density of the stained cells is performed by image analysis.
- 6. The method of claim 5, wherein image analysis is performed by splitting a signal comprising the optical density of the stained biological sample into a multiplicity of signals that are processed using optical filters having different absorption and transmittance properties, so

that each signal is specific for one of a multiplicity of stains used to stain the cells in the biological sample.